Training Solutions, Delivered!

COMPETENT PERSON:
Trenching & Shoring

Leader's Guide, Fact Sheet & Quiz

Item Number: 4056

This easy-to-use Leader's Guide is provided to assist in conducting a successful presentation.

PREPARING FOR THE MEETING

Here are a few suggestions for using this program:

a) Review the contents of the Fact Sheet that immediately follows this page to familiarize yourself with the program topic and the training points discussed in the program. The Fact Sheet also includes a list of Program Objectives that details the information that participants should learn from watching the program.

b) If required by your organization, make an attendance record to be signed by each participant to document the training to be conducted.

c) Prepare the area and equipment to be used for the training. Make sure the watching environment is comfortable and free from outside distractions. Also, ensure that participants can see and hear the TV screen or computer monitor without obstructions.

d) Make copies of the Review Quiz included at the end of this Leader's Guide to be completed by participants at the conclusion of the presentation. Be aware that the page containing the answers to the quiz comes *before* the quiz itself, which is on the final page.

CONDUCTING THE PRESENTATION

a) Begin the meeting by welcoming the participants. Introduce yourself and give each person an opportunity to become acquainted if there are new people joining the training session.

b) Introduce the program by its title and explain to participants what they are expected to learn as stated in the Program Objectives of the Fact Sheet.

c) Play the program without interruption. Upon completion, lead discussions about your organization's specific policies regarding the subject matter. Make sure to note any unique hazards associated with the program's topic that participants may encounter while performing their job duties at your facility.

d) Hand out copies of the review quiz to all of the participants and make sure each one completes it before concluding the training session.

4056 COMPETENT PERSON:
Trenching & Shoring
FACT SHEET

LENGTH: 20 MINUTES

PROGRAM SYNOPSIS:
Being a competent person is not for the faint of heart. The job carries a lot of responsibility. The lives of your coworkers depend upon your professionalism and dedication to safety. This program discusses the requirements, duties and responsibilities of the competent person before and during trenching and shoring operations. Topics include OSHA trenching and shoring requirements, hazardous atmospheres and water accumulation, soil cohesion and stability, the four types of soil, various types of tests for determining soil types and the use of pocket penetrometers and shear vanes.

PROGRAM OBJECTIVES:
After watching the program, the participant will be able to explain the following:
- What the requirements, duties and responsibilities of a competent person are during a trenching and shoring operation;
- What the factors are in determining the cohesion and stability of a soil sample;
- What the four types of soil are as classified by OSHA;
- How to use various types of manual tests to determine soil classification;
- How to use pocket penetrometers and shear vanes to determine soil types.

INSTRUCTIONAL CONTENT:

CAVE-INS ARE PREDICTABLE AND PREVENTABLE
- It occurs year after year: workers needlessly dying in trench cave-ins. The tragedy lies with the fact that these workers should have never been in a situation in which their lives were on the line.
- Based on National Institute for Occupational Safety and Health statistics, an average of 60 workers die in cave-ins annually. According to NIOSH, these deaths are entirely preventable. Let's be clear. These events are not accidents. Cave-ins are both predictable and preventable.
- Fatalities are usually caused by an absence of trench protection, as some employees may risk working in an unprotected trench to save time and money, cut costs, or supervisory or peer pressure.
- A lack of knowledge: employees are often not aware of the hazards and precautions required to minimize the risk of a cave-in. In addition, employees are often not trained in trench hazards or protection techniques.
- Poor judgment by employees leads to misinterpreting trench stability, soil conditions, slope or using improper trench protection methods.

WHY CAVE-INS ARE SO DANGEROUS
- Soil is heavy. A cubic foot generally weighs as much as 100 pounds or more and a cubic yard can weigh over 2,700 pounds or as much as a small truck.
- Most workers don't realize the forces and impact associated with a cave-in. A person buried under only a couple of feet of soil can experience enough pressure to the chest area to prevent the lungs from expanding, causing suffocation.
- Heavier soil and boulders can crush the body in an instant. It's no wonder trench cave-ins result in so many deaths and permanently disabling injuries.
- Remember, while working in trenches and excavations, there is absolutely no room for risk taking. Any condition you ignore or overlook can be fatal.

UNDERSTANDING AND FOLLOWING REGULATIONS AND PROCEDURES
- Training is the key to working safely in trenches. Be sure that you participate in as much training as possible. Also, it is imperative to read and understand the regulations regarding trenching and shoring. You can get a copy from your local OSHA office or by downloading the standards from the web.
- Due to the importance of this information, be sure to follow your company's procedures and carefully read and follow the applicable safety regulations and standards. If you do not understand any part of the standard or requirements, be sure to discuss it with your supervisor to ensure you have the knowledge to work safely.

CAUSES OF CAVE-INS

- Undisturbed soil is kept in place by natural forces as well as the cohesive properties of some soils. When soil is excavated, these natural forces change and can no longer hold back the open trench walls. Soon, the laws of gravity take over, causing the trench walls to move downward and inward into the excavation, resulting in a cave-in.
- Cave-ins are more likely to occur in unprotected excavations where the excavation is dug in unstable soil or in soil that has been previously disturbed; there may be excessive vibration from construction equipment or vehicle traffic; there is excessive weight near the sides of an excavation such as equipment or the spoil pile placed too close to the edge; water has collected in the excavation and degraded the soil stability; changes in weather conditions cause soil to become unstable such as in freezing, thawing, sudden heavy rain or hot dry weather.

OSHA TRENCHING AND SHORING REQUIREMENTS

- OSHA defines an excavation as any man-made cut, cavity, trench or depression created in the earth's surface. A trench refers to a narrow excavation made below the surface of the ground in which the depth is greater than the width.
- The standard requires that if a trench is more than five feet in depth, there must be a protective system in place while workers are in the excavation. It should be noted that in some cases, trenches less than five feet may require protective systems as well.
- OSHA's construction industry standards have been in place since 1971. In 1990, OSHA adopted new standards and requirements for trenching and shoring operations. The new standard took from what essentially was a pamphlet to a highly detailed document that applies to all trenching, excavation and trench protection operations.
- The key component of the new standard is the requirement relating a competent person placed in charge of the excavation and all aspects of safety relating to the job.

THE COMPETENT PERSON

- The term competent person is used commonly in many OSHA standards; however, this program is dedicated to competent persons working in trenching and excavation operations. A competent person is chosen by the employer who by training and or experience is knowledgeable of applicable safety standards and is capable of identifying existing and predictable hazards in the surroundings and or working conditions which are unsanitary, hazardous and or dangerous to employees.
- One of the most important conditions is that the employee has been given the authority to take prompt, corrective measures to eliminate them.
- The standard does not dictate that the competent person must be a supervisor, but common sense and organizational protocol would make this an excellent idea, for without having supervisory authority to stop the job, OSHA is unlikely to consider the employee a competent person. In addition, it is critical that management active support the competent person.

COMPETENT PERSON REQUIREMENTS AND RESPONSIBILITIES

- The competent person must A) be in direct charge of safety on the trenching and excavation project; B) Plan or co-plan all phases of the project. The key is to be involved; C) Perform both visual and manual soils testing; D) Determine which form of trench protection is appropriate in accordance with the standard, hazards and soil conditions.
- The competent person must conduct inspections of the excavation site at the beginning of the day and periodically throughout the shift. Additional inspections must also be performed after any hazard increasing event, such as rainstorms, freezes, thaws, traffic, earthquake tremors, etc.
- A key aspect of the standard is the requirement for the competent person to conduct inspections daily and before the start of each work shift or as required by the work performed; after every rainstorm or other weather event that could adversely affect trench stability such as snow, thaw conditions, windstorms, earthquake or any other dramatic weather change; a change in the size, location or placement of the spoil pile; whenever there is evidence of tension cracking, fissures, bulging, water incursion, sloughing or any other condition or indication where soil stability may be questioned.
- Daily minimum inspections by the competent person also include trenches and excavations, soil properties, areas surrounding the job site, water control systems and protective systems.
- The requirements of a competent person go much further. The competent person must assess the job site for any surface encumbrances or objects or structures which could pose a hazard during the project. Examples might include trees, boulders, foundations, poles, pipelines or conduits, sidewalks or anything that could get in the way of a safe trenching project.
- Where there is evidence of a potential cave-in or other hazardous condition, the competent person must remove the affected employees until the necessary precautions have been taken to ensure safety.
- The competent person must also ensure that all underground utilities have been located. Remember, locators dispatched by utility companies can only provide approximate locations of their lines and systems.
- Never use backhoes, breakers, digging bars or other metal tools to locate or work around utilities due to the electrocution and spark potential.

- The competent person is also responsible to ensure that ladders, ramps and or stairways are provided for all excavations four feet or more in depth. Secure ladders must be placed every 25 feet of lateral travel. In addition, ladders must extend at least three feet above the top of the excavation.
- Here's a tip: OSHA compliance officers will tell you that the main thing that catches their attention when driving by a job is an absence of ladders.
- In situations in which employees are permitted to crossover excavations or trenches, walkways or bridges equipped with standard guardrails must be provided. In cases where there is other potential for falling into an excavation, the general area must be protected by using guardrails or other methods to control access.

HAZARDOUS ATMOSPHERES AND WATER ACCUMULATION

- The standard states that when working in trenches deeper than four feet and locations where hazardous atmospheres are likely to be present, atmospheric testing, ventilation and respiratory protection must be provided.
- The competent person will need to determine if there are any risks of a hazardous atmosphere on the worksite and ensure that testing is conducted to determine if the trench qualifies as a confined space.
- The competent person is also required to assess the job to determine if water accumulation may occur in the trench and to take adequate steps to de-water and properly support the trench walls. Water accumulation and removal must be supervised, monitored and inspected by the competent person to assure adequate water control. Of course, heavy rain will require more frequent inspection and controls to ensure safety.

SOIL CLASSIFICATION

- As a competent person, you must also conduct an analysis of the soil to determine its classification as required by the standards. The classification will help you determine the appropriate trench protection measures to choose.
- The very first thing you must do in order to classify soil is to simply look at it and handle it. That’s right; get your hands dirty.
- You will be conducting an examination to visually determine soil condition. Per the general requirements of the regulation, a competent person must type or classify the soil by using at least one visual and one manual test.
- A visual test could include observing the soil as it is being removed and examining the spoil file looking for clues to help you determine the soil classification. Begin by going to the spoil pile and pick up a number of clumps of soil. By the way, never take samples from within the wall because it is just too dangerous. Look for evidence of the type of soil.
- Does it appear as clay, sand, granular or silt? Look at the size of the individual grains of soil. Are they large, small, clumped or smooth?
- If the soil remains in large clumps and is usually cohesive in nature. Soil that breaks up easily and does not stay in clumps may be granular. Is the soil wet, saturated or submerged?
- Basically, you're trying to determine if the soil content has a high degree of clay or sand. This gives you a clue as to the ability of the soil to remain stable.

SOIL COHESION AND STABILITY

- Soil is generally a mixture of sand, gravel, silts, clay, water and air. The amount and makeup of these ingredients determines its cohesiveness or how well the soil will hold together. Cohesive soil does not crumble. It usually can be molded easily when moist and is hard to break up when dry.
- When you observe clay, it appears as a very fine-grained soil and is very cohesive or sticky. Generally speaking, the more clay that is in the soil, the better the trench walls will hold up. Calcium carbonate also may be present and may provide a cemented property as well.
- Granular soil may have little or no clay content and has little or no cohesive strength. Granular material cannot be molded when moist and crumbles easily when dry. Sand and gravel are coarse grained soils, have little cohesiveness and are often called granular.
- Another factor in soil cohesion is water. Soil that is filled with water is termed saturated. Saturated soil generally does not hold together well and is particularly dangerous in excavation work; however, the opposite can also be true. Soil that has little or no water in it can crumble easily and may not hold together when excavated.
- Next, observe the sides of the excavation looking for cracks or fissures or other evidence of moving ground. Also look for layered soil types. Determine if layers slope towards the excavation and estimate the degree of the sloped layers. Look for evidence of water in the trench or soil as water increases the hazard of a cave-in due to its ability to degrade soil stability.
- Sources of vibration: carefully check the surrounding area for sources of vibration and other hazards which may affect stability.

FOUR TYPES OF SOIL

- OSHA classifies soil into four categories: solid rock, Type A, Type B and Type C. As the competent person, you will also be performing the classification in order to help choose the proper trench protection technique or system. The classification must be based on at least one visual and one manual soils test. Remember, previously disturbed soil can never be Type A.
- Solid rock is the most stable and Type C soil is the least stable. Soils are classified not only by how cohesive they are but also by the conditions in which they are found.
- Stable rock is rarely found in the excavation of a trench. This is because excavation of rock typically requires cutting, drilling and blasting which fractures the rock, making it less stable.
- Type A soil will generally be made up of clay, silty clay or sandy clay. Many OSHA compliance personnel believe that construction equipment at the site create enough vibrations to prevent any soil from being typed as Class A. If vibrations can be felt while standing next to an excavation, the competent person should consider downgrading the soil type.
- A soil cannot be considered Type A if it is fissured, has cracks or other conditions that can adversely affect stability such as subject to vibration from heavy traffic, pile driving or similar effects; having been previously disturbed or excavated or it is part of a layered system where less stable soil is near the bottom of the excavation with the more stable soils on top; subject to other factors which would make it unstable such as the presence of groundwater or freezing and falling conditions.
- Type B soils include both cohesive and non-cohesive soils. They include silts, sandy loams, medium clays and unstable rock. Soils that may be classified as A but have fissures or are subject to vibration may also be classified as B soils.
- Type C soils are the most unstable and therefore the most dangerous of the four soil types. They are usually easily recognized by the continual sloughing of the sides of the walls of excavation. If soil is submerged or water is seeping from the sides of an excavation, it is very probably Type C soil.
- Soil may be classified as Type C if the trench is in layered soils or different soil types lay on top of each other. When an unstable soil type is underneath a stable soil type in an excavation, the weakest link will likely give way.

PREVIOUSLY DISTURBED SOIL

- In many projects, the soil that's being excavated has been previously disturbed. This means the soil has been dug up or manipulated in the past. This is another factor that you as the competent person must consider when typing soils.
- Previously disturbed soil is commonly found above previously existing utilities such as water, sewer, electrical and gas lines. This makes work around these utilities far more dangerous due to the unstable nature of the soil. This could also apply to lots where the soil has been disturbed in order to get to construct homes.

MANUAL TESTING

- The standard allows for a number of tests to be performed to better determine soil classification. Manual tests help to better identify the soil type and cohesiveness.
- It is recommended that your organization retain the services of a soils engineer to provide further training on how best to determine soil type.
- Be sure to careful study the standard and related documents to ensure that you have a good understanding of the tests and methods required to conduct the manual testing.
- Regardless of the methods used, the typing of the soils must be done by a competent person prior to anyone entering the excavation. The weaker or less stable the soil, the greater the need for protective systems. Remember, no one should ever be allowed to enter the trench to perform the testing or take soil samples.
- A manual test means working with the soil with either your hands or with an instrument designed to measure soil strength.

PLASTICITY TESTS

- Some of the manual tests discussed in the standard include the plasticity test used to help to determine if the soil contains cohesive material.
- To perform this test, find a palm size sample of moist or wet soil and mold it into a ball and then attempt to roll it into threads about one-eighth inch in diameter. If the soil contains cohesive properties, it can usually be rolled into threads without crumbling.
- If at least a two-inch length of one-eighth inch thread can be held on one end without tearing, the soil appears to be cohesive. If the soil will not roll or thread, the material would not be considered cohesive.
- Another plasticity test is known as the ribbon test. It is conducted in a similar manner but rather than rolling into a thread, a larger roll is used and squeezed between the thumb and forefinger. If it ribbons around the hand, it may contain a sufficient amount of clay to be considered cohesive.

THE DRY STRENGTH TEST

- Another test is known as the dry strength test. To conduct this test, get an undisturbed sample from the spoil pile. By the way, undisturbed means that you are testing it as you found it and have not added water or disturbed it in any other way.
- Now, use your thumb or fingers to apply light to moderate pressure to the sample. I f the sample easily crumbles into individual grains or powder with moderate pressure, the soil is usually considered granular.
- If the soil is dry and breaks into clumps which in turn break into smaller clumps which can only be broken with difficulty, it may be clay in combination with gravel, sand or silt and therefore may be cohesive.

THE THUMB PENETRATION TEST

- The thumb penetration test can be used to estimate the unconfined compressive strength of cohesive soil material and classification. When performing the thumb penetration test, it must be done on an undisturbed excavated soil sample such as a lump of material about the size of a baseball.
- This test should be performed as soon as possible after excavation as to reduce the effects of drying or additional water.
- Begin pressing your thumb into the sample. Using just thumb pressure, if you cannot penetrate the sample or just barely indent the soil, the standard indicates that it may be Type A soil. According to the standard, Type A soils have an unconfined compressive strength of 1.5 tons per square foot or greater and cannot readily be indented by thumb pressure.
- Type B soils are those with .5 to 1.5 times per square foot of unconfined compressive strength and can generally be penetrated to the first joint of the thumb.
- Lastly Type C soil as an unconfined compressive strength of .5 tons per square foot or less and can easily be fully penetrated by the thumb and can be molded by light finger pressure.

THE POCKET PENETROMETER

- Be aware the major concern with using the thumb penetration test is that you have no hard data to support your findings should you need to defend your position at an OSHA hearing.
- One very useful instrument for measuring soil strength is a pocket penetrometer. These inexpensive instruments are key in helping to calculate the unconfined compressive strength of the soil.
- When you press this instrument into a soil sample, it measures its unconfined compressive strength in tons per square foot, or TSF.
- When using the pocket penetrometer, 1) perform the test on an undisturbed excavated sample of soil such as a large clump. Shave off a clean spot that is free of rocks and other debris; 2) Following the manufacturer's instructions, move the ring or plunger to the lowest reading on the handle; 3) Grip the handle and with steady pressure, push slowly until the soil reaches the marking on the piston about 1/4 inch from the end; 4) Read the unconfined compressive strength in tons per square foot, or TSF, on the indicator; however, be sure to follow the manufacturer's instructions for your instrument; 5) Take eight to 10 readings and take an average of the findings to come up with a final calculation for unconfined compressive strength.
- Be sure to document your findings in the event you have to prove them to a compliance officer.

THE SHEAR VANE

- Another instrument that might be of use is a shear vane. Use this instrument according to the manufacturer's recommendations, again being careful to read and follow the instructions.
- Since the shear vane measures shear strength as opposed to unconfined compressive strength, you will need to double the number to get the correct result.
- Again, take a number of samples and calculate an average. Do not forget to document.

OTHER TESTS

- The drying test may be used but the basic purpose is to differentiate between cohesive material with fissures, unfissured cohesive material and granular material. This test should be conducted by a qualified individual.
- A fun test to perform is known as the mixed media or olive jar test. This test can be used to help estimate the amount of clay, silt and or sand in a soil sample.
- It requires quite a bit of work to perform as you must take four to six shovels full of soil, removing all rocks and other debris. Mix thoroughly, then cut into quarters and throw out two. Mix and repeat at least two more times, mixing the final sample again.
- Generally, a tall jar is used with a mark at about 1 1/2 inches from the bottom. The soil sample is placed in the jar up to the line and water is added to the top, about five to six inches of water. The jar is shaken vigorously, given a twist and the sample timed.

- The types of soil within the jar will dictate how quickly they settle out. For example, if 80 percent of the soil settles out within the first 30 seconds, the soil is generally Type C material. If after 30 seconds, 70 to 80 percent of material does not settle out, it could be Type B soil.

DETERMINING TRENCH PROTECTION AND SUPPORT MEASURES

Once you have determined the soil classification, you will now be able to use this information to help determine the appropriate trench protection and support measures or systems for workers. Consult the standard and tables within the standard that corresponds to the soil classification. You will be choosing between a shoring system, sloping or benching and or a trench box system.

COMPETENT PERSON:
Trenching & Shoring

ANSWERS TO THE REVIEW QUIZ

1. a
2. b
3. b
4. a
5. b
6. d
7. c
8. b
9. c
10. c

COMPETENT PERSON:
Trenching & Shoring
REVIEW QUIZ

The following questions are provided to determine how well you understand the information presented in this program.

Name_____Date_____

1. A person buried under only a couple of feet of soil can experience enough pressure to the chest area, causing suffocation.

a. True
b. False

2. A competent person does NOT have to perform visual and manual soils testing.

a. True
b. False

3. It is NOT necessary for the competent person to conduct an inspection after every rainstorm or other weather event.

a. True
b. False

4. It is NOT permissible to use backhoes, breakers, digging bars or other metal tools to locate or work around utilities.

a. True
b. False

5. The competent person is responsible to ensure that ladders, ramps and/or stairways are provided for all excavations 10 feet or more in depth.

a. True
b. False

6. When taking a soil sample, you should look for _____.

a. Type of soil
b. Size of the individual grains
c. Soil that breaks up easily
d. All of the above

7. A cubic foot of soil generally weighs as much as _____ pounds or more.

a. 75
b. 80
c. 100

8. Secure ladders must be placed every ____ feet of lateral travel.

a. 10
b. 25
c. 50

9. If a trench is more than _____ feet in depth, there must be a protective system in place while workers are in the excavation.

a. 3
b. 4
c. 5

10. Type A soil is generally made up of _____.

a. Cohesive and non-cohesive soils
b. Soil that is most unstable
c. Clay, silty clay and sandy clay
d. All of the above